

Background Concentrations In Setting Sediment Cleanup Standards

Issue

How should we consider background concentrations in the Sediment Management Standards (SMS) when making decisions about sediment cleanup standards at cleanup sites?

Overview

The purpose of the SMS is to reduce and ultimately eliminate adverse effects on biological resources and significant threats to humans from surface sediment contamination. It is also important to consider the very real issue of widespread contamination. Ecology recognizes the need to protect people and the environment and understands certain practical limitations about how much sediment contamination we can actually clean up using remediation technologies.

Contaminants from both man-made and natural sources are widespread in the State's waters. It may not be feasible to clean up some chemical contaminants in sediment as much as we would like to protect people and the environment. Some contamination may be technically impossible or cost prohibitive to clean up to the very low concentrations that fully protect humans and the environment. This is especially so for chemicals that [biomagnify](#) and are eaten by other fish, people, and animals. Considering background concentrations when setting [sediment cleanup standards](#) is one way to address practicality in cleaning up sites.

The SMS do not provide details on how to address human health risks from sediment contamination, or how to consider background chemical concentrations when setting sediment cleanup standards. [Model Toxics Control Act](#) regulation procedures for soil and water cleanup levels to protect human health are often applied to setting sediment cleanup standards. The regulations have different approaches for how cleanup standards are selected and how background is defined. These create confusion during the cleanup process.

Ecology is considering options to solve this problem and bring clarity to the regulations for cleaning up contaminated sediment sites.

- How cost and feasibility are considered in the cleanup process, including the selection of sediment cleanup standards.

- Whether to use MTCA definitions for [natural](#) and [area background](#), or to develop a new background definition for sediment cleanup standards.
- Whether procedures need to be defined to determine background sediment chemical and tissue concentrations, and how to compare site chemical concentrations to background concentrations.

Problem Statement

Sediment cleanup goals based on acceptable human health risk levels may be below background chemical concentrations. This may be especially true for contaminants that [bioaccumulate](#) in aquatic organisms and [biomagnify](#) in the food chain. In some cases, risk-based cleanup goals for bioaccumulative contaminants are also below current laboratory capabilities to detect them. Determining background concentrations is critical for establishing site-specific sediment cleanup standards that are both [practicable](#) and as protective as possible.

Some contaminants are so widespread that it may not be feasible to achieve fully protective concentrations under current cleanup regulations. When setting sediment cleanup standards, Ecology may choose to consider whether it is technically possible to clean up large areas of a waterbody, such as an entire bay.

Setting practical sediment cleanup standards allows more cleanup actions to be completed in a shorter amount of time, resulting in overall reduction of human health risks and environmental impacts. Our goal is to clean up contaminated sites quickly and efficiently, while protecting people and the environment.

Sediment background is generally more difficult to determine than soil background. Soil has relatively less movement than sediment. Sediment is moved by the water, and may be transported over large areas causing widespread sediment contamination. Contaminants tend to be higher near urban areas and the nearshore environment. Urban areas can have many diffuse nonpoint sources contributing to sediment contamination.

The Model Toxics Control Act (MTCA) rule approach for background was developed for soils, while the SMS does not specify how background will be considered in setting sediment cleanup standards. In the MTCA rule, the cleanup standard can be set at [natural background](#) if natural background is higher than the concentration associated with the MTCA rule acceptable human health risk level.¹ [Natural background](#) is defined in the MTCA rule as “the concentration of hazardous substance consistently present in the environment that has not been influenced by

¹ The [risk levels](#) described in MTCA rule are the lowest concentration based on: 1.) a 1×10^{-6} risk level for any one carcinogenic chemical and single exposure pathway, and 2.) 1×10^{-5} risk level for all [carcinogenic](#) chemicals combined and multiple exposure pathways, and 3.) a [hazard quotient](#) of 1 multiple for non-carcinogenic chemicals and/or multiple exposure pathways.

localized human activities.”² There has been difficulty in determining what *natural background* concentrations are for sediment because of the ambiguity in what is meant by “localized human activities”.

In some cases, MTCA rule Method C allows cleanup standards for surface water, groundwater, or air to be set at area background, but a number of conditions apply. The cleanup must still comply with applicable state and federal laws, have used all practicable methods of treatment, and not exceed an estimated excess cancer risk of one in one hundred thousand (1×10^{-5}).³

The SMS rule does not specify how background is defined when setting sediment cleanup standards for human health protection. In rare cases where there are elevated concentrations from [nonanthropogenic](#) sources, an area background may be used.⁴

These differences in SMS and MTCA rules create confusion when making decisions at sediment cleanup sites.

Options

How should background concentrations be considered when making decisions about sediment cleanup standards?

The issue of background in setting sediment cleanup standards at cleanup sites is entwined with the issues of human health, and the decision-making process for setting [cleanup standards](#) and [remedy selection](#). Human health considerations in setting sediment cleanup standards are covered in more detail in a separate paper, but are discussed briefly here.

There are three regulatory layers related to background considerations in setting sediment cleanup standards: 1) decision-making framework 2) definition of

² WAC 173-340-200. “[Natural background](#) means the concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities. For example, several metals and radionuclides naturally occur in the bedrock, sediments, and soils of Washington State due solely to the geologic processes that formed these materials and the concentration of these hazardous substances would be considered natural background. Also, low concentrations of particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due to global distribution of these hazardous substances. The low concentrations would be considered natural background. Similarly, concentrations of various radionuclides that are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background.”

³ WAC 173-340-706 (1) (a) and WAC 173-340-706 (2).

⁴ WAC 173-204-320 (6) Puget Sound marine **nonanthropogenically affected sediment quality criteria**. Whenever the nonanthropogenically affected sediment quality is of a lower quality ...than the applicable cleanup screening levels or minimum cleanup levels criteria established under this section, the existing sediment chemical and biological quality shall be identified on an area-wide basis as determined by the department and used in place of the standards of WAC 173-204-520.

background 3) background statistical methods and sample locations. Each of these aspects is explained in more detail below.

1. Decision-making framework.

The decision-making framework provides a regulatory approach for making decisions about setting [cleanup standards](#) and choosing [cleanup action](#) alternatives. This topic is described in more detail in the Human Health Issue Paper and the MTCA Integration Paper. Ecology would like to clarify how considering background concentrations will fit within the framework.

2. Definition of background.

Ecology is considering different definitions of background in setting sediment cleanup standards.

- Do nothing and continue using the MTCA rule definition of *natural background* for setting sediment cleanup standards.
- Adopt in SMS the MTCA rule definition of [natural background](#) for setting sediment cleanup standards.
- Adopt in SMS the MTCA rule definition of [area background](#) for setting sediment cleanup standards.
- Define *background* applicable to sediment cleanup standards, which may include differentiating between basins, or urban and non-urban areas.

3. Statistical methods and background sample locations.

Ecology is evaluating whether these technical details should be addressed in regulation or would be better addressed in guidance. To determine appropriate background concentrations, some of the relevant questions include:

Which locations are appropriate reference locations for background samples relevant to cleanup sites?

Ecology is considering a number of options:

- For natural background in Puget Sound, sample locations in Puget Sound main basin far from urban influences and local sources.
- For Puget Sound, use different reference locations for urban and non-urban areas, or sub-basins.
- For other environments, use all lakes and rivers lumped together, or look at waterbodies individually.

How many samples will be needed to perform a robust statistical analysis? How will non-detects be treated in the statistical analysis?

Ecology is considering a number of options:

- Ecology collects data at reference sites and publishes a background concentration based on concentrations at the reference site.
- Each individual project collects data from an approved reference site. The minimum number of background samples required is specified either in guidance or in rule.
- Ecology is evaluating whether non-detect data should be included in the statistical analysis using simple substitution, such as method detection limit or ½ method detection limit.
- Ecology is evaluating whether non-detect data are included in the statistical analysis using statistical methods that estimate the distribution of non-detect values.

What statistical tests should be used to compare site data to background concentrations? What are appropriate metrics?

Ecology is looking into a number of related questions:

- What level of uncertainty is acceptable?
- Should we compare central tendencies such as mean, median, or confidence interval on the mean?
- Should we compare levels at the upper end of data, such as the 90th percentile, or mean plus two standard deviations?
- What method(s) do we use to compare data from a cleanup sites to data sets representing background?
- How do we compare exposure point concentrations in the area of concern to a background datasets?
- What statistical software that can be used for the analysis such as MTCAsat, MyEIM, or ProUCL?⁵

⁵ “MTCA stat” is a statistical spreadsheet developed by Ecology for computing MTCA rule statistical methods. “MyEIM” is an analytical tool associated with Ecology’s Environmental Information Management (EIM) database that provides statistical analysis of EIM environmental data. “ProUCL” is a free software statistical package developed by US EPA to test data distributions and compute Upper Confidence Limits (UCL) on the mean.

Factors to Consider When Selecting an Option

The development of the amendments will involve the consideration and balancing of a number of issues and interests. The proposed amendments will also be developed to satisfy several, sometimes conflicting, regulatory goals, including the following:

- Providing for the selection of cleanup actions that protect human health and the environment.
- Developing scientific and legally defensible cleanup standards.
- Providing consistent standards and methodologies for assessing and managing risk.
- Providing flexibility to address site-specific factors.
- Promoting efficient and cost-effective cleanup of contaminated sites.
- Improving the clarity and usability of the SMS and MTCA rules.
- Whether the option complies with key requirements of the Administrative Procedures Act.